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Possibilities of Dynamical Condition Control in Technical Systems under Vibration Excitation

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Abstract

The method of mathematical models creation for the mechanical oscillatory systems containing mechanical movement transformation chains is suggested. A mechanical chain represents two symmetric groups of Assur interconnected with an elastic element and the device for transformation of movement of type of not self-slowning down screw mechanism. The features of the system dynamic properties are shown in the cases of power and kinematic excitation. The analytical ratios defining the dependence of the reduced masses and stiffness on the parameters of the introduced mechanisms are received. The analytical conditions for the possible change of the type of amplitude-frequency characteristics are received at kinematic excitation. It is shown that the introduced movement transformation devices can be used to setup the parameters of oscillations dynamic damping and to change the eigenoscillations frequencies.

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1. Introduction

Small oscillations of details and mechanical units and their vibratory interactions are characteristic of the technological machines and vehicles, ones are working in the conditions of intensive dynamic loadings of actions [1-5]. Decreasing of vibratory impacts on object of protection and control of its dynamic regime is provided at the expense of ways and means of vibration protection and a vibration isolation from sources of external and internal excitations [6-10].

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Introduction to structure of vibroprotection of various mechanisms and converters of movement plays an important role in the design-technological plan, and also in different realization of dynamic effects, which related with problem solving of decrease of fluctuations of an object of protection. A number of questions of dynamic synthesis of this sort of systems of vibration protection is considered in references [11-15].

Original approaches to formation of dynamic properties of vibroprotective systems are considered in the offered paper on the basis of introduction of mechanisms of the different types having properties to change dynamic state variables of vibroprotective system.

2. Basic provisions. Research problem statement

The system of vibration protection is considered. The system consists of the main unit. The object M with a spring k_0 and a special mechanical oscillating contour are included in main unit. Contour is formed by the hinged-lever mechanisms. Mass inertial elements m are fixed in hinges A and B . Besides, points A and B are connected among themselves by an elastic element k (see Fig. 1).

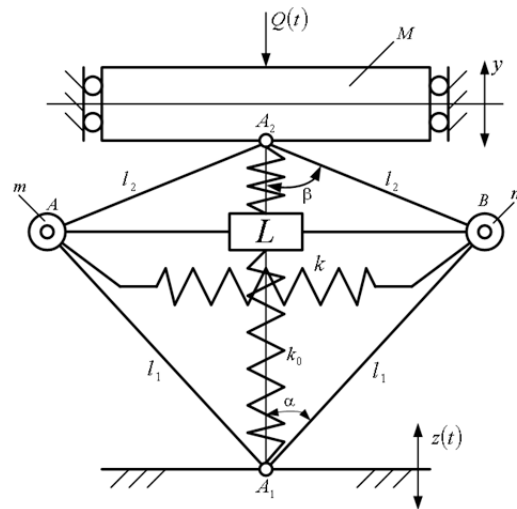


Fig.1. Design scheme of vibroprotection system with adjustable elastic-mass parameters.

Arising inertial forces are defined by parameters of relative movement of points A and B . It is necessary that the weight of the device for movement transformation (L) is small also one is not considered at definition of kinetic energy of system. Harmonic force Q attached to object of protection (M) and kinematic vibration of foundation $z(t)$ are considered as external excitation.

The research problem is to develop a method of construction of mathematical models for vibroprotective systems into which composition the mechanisms creating additional forms of interactions of elements and new physical effects in controlling regimes of dynamic status of system are entered.

3. System is subjected to harmonic exciting force ($Q \neq 0, z(t) = 0$)

The schematic diagram of kinematic proportions in the relative movements of elements of system is provided in fig. 2.

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